USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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Cybernetics, Computers and Automation Technology

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Moscow TRUD in Russian 1 Aug 85 p 2

[Interview of G.I. Kavalerov by A. Pankov, "Factories Await Automation; Questions of Speeding Up Scientific-Technical Progress are Discussed by the Minpribov USSR Collegium," under the rubric "On the Paths of Technical Progress: Horizons of the Branch."]

> [Text] Microelectronics, computer technology, and instrument building were named as catalysts of progress at the meeting of the CPSU Central Committee. In fact, the automation and mechanization of practically all processes in all branches of the national economy depend on them. A business-like, self-critical discussion by the Minpribor board took place in regard to the responsibilities of industries for accelerating scientific-technological progress. Our special correspondent discusses with Deputy Minister G. I. Kavalerov the ways of achieving the measures planned and of overcoming the lagging of industries behind world standards in some positions.

"[Pankov] Geniy Ivanovich, as was noted at the USSR Central Committee meeting, all industries face the problem of accelerated technological re-equipping of each enterprise and of producing machines and equipment, which are not inferior to world standards. What types of your products at the present respond to the great needs of the day?"

"[Kavalerov] First of all I note that in the current Five-Year Plan the development and production of the basic types of our products are under way in accord with the All-Union program for solving important scientific-technological problems. And many new models of instruments and automation equipment that do not lag world standards are being produced.

"Thus, the Control Problem Institute and the Severodonets NPO [Scientific-Industrial Association] 'Impuls' produced high-speed computer systems of types PS-2000 and PS-3000 which can carry out two hundred million operations per second.

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"At the Kharkov NPO for Automated Control Systems, a new generation 'MikroDAT' hardware system was developed, which can be used to produce high-efficiency information-control systems for power plants, machine construction, metallurgy, and some other industries. Additional examples can be given."

"[Pankov] And for all that, it is still too early to talk about the satisfaction of other industries in regard to both quality and quantity of automation and measurement equipment..."

"[Kavalerov] Yes, there was a very serious and business-like discussion by the ministry board about that.

"Although our branch is growing at accelerated rates, nevertheless the need for the renovation of technology increases even faster, and we are not meeting it completely. Presently, steps are being taken for an intensive buildup of instrument manufacture. That's with respect to quantity.

"Now in regard to quality, this raises the challenge of not only adopting new, advanced types of products, but also of raising the reliability of all of our products. The branch has good experience in producing instruments and automation equipment that is capable of operating reliably for tens of thousands of hours. Via the industrial program 'Kachestvo [Quality]' and additional measures, adopted after a meeting in the USSR CPSU Central Committee, it is intended to extend the experience of leading collectives to all plants, and to produce all products to modern standards. This will make it possible after a year and a half to two years to eliminate the lag in quality between different types of production."

"[Pankov] There are no industries of the national economy for which you do not manufacture measurement, control, and automation equipment. From the simplest instruments for weighing and for measuring temperatures to large computer systems—such is the range of your production. And increasingly important, in all industries new equipment is also needed. But there are priority industries. Tell us about the work in that direction."

"[Kavalerov] First of all, it is machine construction where increased automation of industrial processes is necessitated by the very large scale. Even now we are greatly increasing the production of control systems for machine tools with ChPU [numerical program control] for flexible manufacturing systems and automated production. In the coming Five-Year Plan the rate of growth will increase even more. The continuous functioning character of modern technology necessitates automatic control. We are working on the development of equipment for the technical diagnosis of the state of different machines, for the accurate detection and prediction of defects, and also on instruments for nondestructive testing methods that will make it possible to examine the quality of such important products as pipe, rails, and castings.

We are giving greater consideration to the production of all kinds of control instruments and systems for the mining industries, fuel-power generation complexes, and geology. And we are fulfilling an important social commission—the production of instruments for testing the state of the environment.

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"In the past three years the production of instruments for agriculture has increased by two and a half times. And in the next Five-Year Plan the same rates are planned for further expansion of their production."

"[Pankov] The path from idea to implementation becomes longer if only because of the great amount of time that is spent on the purely mechanical operation of drafting. Both designers and engineers are expecting the maximum amount of help from your industry to automate their work. What are you proposing for them in the near future?"

"Not long ago, the delivery was begun of modern microprocessor automated work stations (ARM) to various industries for the designers of all kinds of articles for machine construction and radio-electronic equipment and also for programmers. Automated systems have been developed for designing industrial processes with the output of operating programs to numerical program control-equipped machine tools. The series production of automation equipment for design work in construction was begun.

"Automated design systems not only reduce the work of engineers but also assist in determining the best design of a product, increase the reliability and producibility of the product, and decrease the amount of materials used. Labor costs using the new design technology are reduced by factors of 10-20 or more.

"Propectively, the separate automated systems for designing, for technological production, engineering and for management by the enterprise should be unified into a single integrated automated system--the automated design office."

"[Pankov] To solve the problems of accelerating the scientific-technological progress in the country, your industry itself must grow at increasingly faster rates. What is the ministry undertaking in this regard?"

"[Kavalerov] We consider our very important achievement to be the gain in production output without an increase in the number of workers. And we are determined to maintain this favorable trend in the new Five-Year Plan.

"The fraction of manual labor at our enterprises is lower than in many other industries. Nevertheless, it is still relatively high.

"We are giving paramount importance to the automation and mechanization of processes at all enterprises in accord with the needs expressed at the meeting of the CPSU Central Committee for a sharp increase in productivity and a fundamental change in working conditions.

"Our industries are characterized by a large proportion of instrument assembly and adjustment work. Therefore we are emphasizing the use of manipulators and industrial robot systems. Even in the present Five-Year Plan it was intended to make by our own efforts around 30 thousand robots for the assembling and painting of instruments and for the automation of punch presses and auxiliary operations. This would free approximately 40 thousand workers by the end of 1986.

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"The use of 'miniature' electronic--microprocessors, built-in microcontrollers, and microcomputers--is expanding significantly. So during the current Five-Year Plan the use of microprocessors in the branch was increased by almost 20-fold.

"We are counting on integrated automation and on the installation of flexible automated production. It is expected that in 1988 the First and Second Moscow Watch Plants will be fully automated enterprises.

"In the technical refitting of the enterprises, more than two-thirds of the capital investment is being expended on reconstruction. The rates in the future will also be similar. Overall we are proposing to free around 140 thousand people in the 12th Five-Year Plan."

"[Pankov] Are you contemplating modifying anything in the work of designers and technologists in the light of experiments such as the one going on in Leningrad?"

"[Kavalerov] That question likewise was one of the most important at the meeting of the ministry collegium.

"We are planning to extend the experience of our VNIKISChPU [All-Union Scientific Research and Design Institute for Numerical Program Control Systems, which is a part of the 'Leningrad Electrical Engineering Plant' association, which organizes the work of specialists on a new principle. This is essentially a brigade approach to the work of designers. It increases interest and responsibility. The development time decreases by 30-40 percent."

"[Pankov] What does the ministry plan in the light of the rising demands for branch science, stated at the meeting of the CPSU Central Committee, on the issue of accelerating scientific-technological progress?"

"[Kavalerov] Much scientific potential has been developed in the branch. A number of our organizations were very successful in creating new forms of techniques and technologies. For example, the Institute of Control Problems, under the methodological leadership of the USSR Academy of Sciences, is an indigenous center for the development of control theory and methods. Its development is tightly connected with industry. The Serevoconets NPO 'Impuls' is functioning successfully in regard to developing computer control technology. An appreciable contribution to the development of instruments for agriculture was made by the Tbilisi NPO 'Analitpribor'.

"However, we do not delude ourselves, the problems the branch's science are many. And the main direction for increasing its effectiveness is to bring it closer to production. We are planning by the assignment of NII [scientific research institutes] and KB [design offices] to plants to triple the number of scientific-production associations and to enlarge the present ones. The NPO will be directly subject to the authority of the ministry without any intermediate links. In our branch there are good working relations with basic science and they will become even better in the future. That is to say, a variety of steps are being taken so that Soviet instrument manufacture will in no way lag behind world standards and it will assure the feasibility of accelerating developing in all directions of our national economy."

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POSSIBILITY OF ARTIFICIAL INTELLIGENCE IN COMPUTERS

[Article by Yuriy Matveyev, postgraduate student of Chair of Semiconductor and Electrovacuum Technology, Faculty of Instrument Building and Automation, Riga Polytechnical Institute imeni A. Pelsche: "Can a Machine Be Taught to Think?"]

[Text] A long path has been covered from the first computers to today's most powerful computer complexes--all in three decades. No other area of human activity has known such progress. Such basic parameters as a speed of hundreds of millions and billions of operations per second and memory capacities of hundreds of millions of bits are achievable for modern computer systems. The time is not far off when computers will achieve, at least in the quantitative sense, the complexity of the human brain (of course, complexity according to our present concepts).

The concept "artificial intelligence" was born in cybernetics. It permits one to classify objects and to combine successfully a number of properties of computers and similar qualities of human intelligence. Systems based on computers that claim to have intelligence have been developed within the framework of cybernetics. One of them was developed at the Institute of Cybernetics, Ukrainian SSR Academy of Sciences, and can exchange questions and answers with a human at the level of a four or five-year old child; moreover, as the system communicates with people, teaching itself, it increases its intelligent capabilities. A medical diagnostic system has been developed in the United States which "converses" with the patient at the level of a qualified physician, but only within the framework of medicine. The slightest violation of the rules of the game by the patient stops the system cold. Thus, cybernetics already specifically studies problems of artificial intelligence and has specific developments at its disposal.

Some of the latest advances of microelectronics, robotics and other fields provide yet another impetus for concepts about artificial intelligence.

Pattern recognition was discussed long before the appearance of the term "artificial intelligence." This problem arose from practical needs--recognizing the tracks of elementary particles in bubble chambers, interpretation of aerial photographs and so on. The development of robots, which adequately reflect their surrounding situation by using vision, has now become noteworthy. The

significance of these robots for development of industry is difficult to overestimate.

Speech analysis and synthesis is a comparatively new direction in development of technology, in which nevertheless considerable success has been achieved. Methods and equipment have been developed for speech synthesis in real time in several languages, including a complex language--Japanese. Technology has far outstripped fantasy: instead of the monotone metallic voice of robots, it has become possible to select pitch, intonation, male or female voice. The results are more modest in the field of speech analysis: machines can recognize words from a limited vocabulary--up to 1,000 words. But even from a practical viewpoint, this is a gigantic achievement.

And finally robotics. This is a very young sector. However, I would like to note two characteristic features of modern industrial robots: they are capable of performing several different operations, that is, of adapting themselves to environmental conditions, and in some cases they have structural elements that are reminescent of parts of the human body and primarily of the human hand.

Thus, modern machines can see, hear, speak, act and, with numerous stipulations and constraints, can think. The developing situation differs fundamentally from that which occurred with ordinary tools of labor--let us say, with an excavator or aircraft. The excavator digs better and faster than a man and the aircraft permits man to fly. However, neither the capability of digging nor the ability of flying is a characteristic feature of man. We are now concerned with infringement on functions that are considered the exclusive perogative of man. In this sense, one can talk about the problem of artificial intelligence, since the contradiction between the historically established "sharing of labor" between man and machine and the established new capabilities of machines is evident.

This problem arise at the juncture of many sciences: cybernetics, mathematics, psychology, biophysics and neurophysics. Each of them provides its own concept of artificial intelligence. Each of these concepts has its own accent.

According to one of the definitions, "one can consider intelligence as the capability of a decision-making device achieving some success in searching for a wide variety of targets in a wide range." Intelligence is defined here in terms of the behavior of a device (or a being) approaching a target, while the degree of intelligence is measured by the adequacy of the decisions made. The advantage of this approach is that universality and flexibility are regarded as significant features of intelligent behavior. It is also important to recognize the essential relationship with the environment. However, there is nothing to be said here about the source of the specific assumption: if this is a goal posed by man, then the limitation of this intelligence is obvious compared to natural intelligence; if this is a goal postulated by a machine, the question arises of what this goal is from the viewpoint of the machine and what is its nature?

Artificial intelligence is also defined as "methods and approaches that permit one to predict the behavior of an object in a specific situation with minimal

a priori concepts about the object." This is also a functional definition, but more general than the previous definition.

A. Turing's criterion, which includes a special test procedure, is also popular. A man is in a room, behind the wall of which is placed an unfamiliar "interlocutor." The problem of the "examiner" is to determine who is behind the wall: man or machine. If the "examiner" is unable to recognize the machine and states that a man is behind the wall, then one concludes that the machine has artificial intelligence. The "examiner" and "interlocutor" communicate over a limited communication channel, for example, by using an electric typewriter.

Based on Turing's criterion and also taken into account that artificial "interlocutors" have already been developed, which was mentioned above, and the prospects for development of electronics, computer technology and mathematical methods, many specialists conclude that it is possible to create artificial intelligence.

But Turing's criterion also has a significant deficiency. First, subjective opinion is taken as the basis and in the best case collective subjective opinion is taken; second, intelligent decisions from a machine can be achieved for a finite class of situations. But reason is not reduced to solving special tasks, even such complicated tasks as playing chess or proving theorems; third, Turing's approach is essentially limited by the fact that thinking and intelligence are regarded only as phenomena. Studying nature and specifically reason, we should proceed "from phenomenon to essence."

Thus, no clear, exhaustive definition of the concept "artificial intelligence" has yet been suggested in the literature; therefore, it makes sense to compare the characteristic properties of natural and artificial intelligence.

First, an heuristic search in investigation of artificial intelligence is applicable to problems in which the initial situation is clearly denoted and a goal is postulated, whereas natural intelligence solves the problem by methods of specific, impulsive action and skills. This difference for artificial intelligence makes no sense. Preliminary investigative actions are inherent to natural intelligence: examination and following contacts. Second, when describing states, man uses subjectively correlated images, values and ideas and does not operate in vectors, lines, lists and numbers. And third, an heuristic search for natural intelligence has a lifferent nature compared to artificial intelligence. The rate of search depenas on subjective factors-- motives, mental state, degree of preparation. Subjective factors for artificial intelligence as yet make no sense.

The difference between machine and human intelligence lies in deep spheres-- in the sphere of mental categories. The idea of reactions of a machine is in the postulated goal. But a machine absolutely and literally understands the goal and can conclude, for example, that a "guillotine is a much better device for dryness of the throat." Thus, goals must be posed with all stipulations. It is incorrect to say that a machine will never pose goals. A goal has already been placed in the process of heuristic search for a number of problems.

Certain other features are typical for human intelligence: postulation of problems that do not follow from need, refusal of attempts to achieve senseless goals. And, finally, yet another difference. Human reason is social in nature. Machines do not have the capability inherent to man of responding to themselves: let us imagine Turing's "inverted" experiment--a machine-"examiner" will hardly be able to recognize the "interlocutor" behind the wall. The tendency of machines toward socialization has also not yet been detected and predicted by science. Thus, the notorious rebellion of machines is not a union of machines against man, but malfunction of them or the fruit of human fantasy.

Thus, all forecasts of special sciences with respect to artificial intelligence are based on the careless hypothesis that the brain and machine function identically. Characteristics existing in both machine and man--speed, capacity of memory, accuracy and so on, by which the advantage of machines is obvious, are taken into account in the comparison. Such human "characteristics" as need, motives, specific assumptions, emotional regulation of activity are beyond consideration. Conclusions are also made about the possibility of developing a machine that is even more intelligent than man. But as we will see, this conclusion is incorrect. The problem of the possibility of artificial intelligence reduces in the philosophical aspect to a problem of "is consciousness conceivable?" It is logically similar to the popular sophism about the omnipotence of God: "can God create a stone that he cannot lift?" One must understand with its consideration that, recognizing the secondary nature of consciousness with respect to matter, we do not reduce consciousness to the simplest forms of the motion of matter. Consciousness is not identical to the brain, but is located with it in complex relationships. It is considerably more complicated than the relationship of information signals to information channels.

Without understanding this, formally standing on positions of materialism, the earlier proponents of cybernetics rejected machines and rightfully called them models of thinking and accused cybernetics of the fact that it clearly reduces thinking to simple forms of motion.

The strategic goal in developing devices with artificial intelligence is to bring machine methods of problem-solving as close as possible to human methods. Thus, a new approach to the problem of artificial intelligence is borne. This approach essentially means a separate method of recognition--modeling.

There have been the first successes in this direction--this is development of heuristic methods in the form of chess programs and development of systems that have "embryonal" intelligence, which were mentioned above. It is understandable that one cannot forget about traditional methods of understanding with all the pluses of simulation.

Models developed during investigations of artificial intelligence and methods of using them are extremely important even today for solving applied problems. If one talks generally about simulation, then one can state daringly that the development of science is now unthinkable without it. There are many different scientific problems, for which simulation is the most effective and sometimes the natural method of solution (for example, control). Simulation is widely employed in the natural sciences--physics, chemistry and biology. Attempts are also known of using simulation in sociology.

Artificial intelligence should be understood as a reflection of the level of understanding achieved by man. As artificial intelligence develops, that is, as it approaches natural intelligence, consciousness itself makes a significant step forward. One should carefully state in this regard that artificial intelligence will reach or even exceed natural intelligence. Thus, development of the problem of artificial intelligence promises to provide a powerful impetus to the understanding of human thinking.

BELORUSSIAN COMPUTER SPEAKS, READS GRAPHICS, X-RAYS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Apr 85

[Article by G. Novikov, under the rubric "A Demand on the Future: I See, I Say, I Draw."]

[Text] The information-management complex created at the Special Design-Engineering Bureau (SPTB) of Management Systems of the Belorussian SSR Ministry of Housing and Communal Services can solve the tasks of management of a branch, conduct an economic analysis and plan, hear, speak, see items of various forms and volumes, and "read" graphic information.

"One can speak with the electronic computer, but to do so it isn't at all necessary to go into the machine room. It's simpler to call on the telephone," the director of the SPTB, Candidate of Technical Sciences E. Medvedev, said in response to a request to be shown the work of the complex. "Incidentally, a wide circle of specialists can consult by telephone with the machine. To do so it's unnecessary to master the fine points of the profession of computer operator. A talk with 'Intellect,' as we call the complex, is carried on in a normal language."

Eduard Mikhailovich dialed the necessary number. A click sounded, and from the loudspeaker a voice resounded: "Connection with the information-management system established."

The electronic conversation partner spoke precisely and intelligibly. And even the barely-audible metallic notes in the voice didn't immediately reveal that the sound was "mechanical," and not human speech.

"Shall we give it a little more complicated task?" suggested the director. "Ask it to calculate the optimal water-supply regimen for the republic for next year--without a computer's aid, an economist would need three months or so for that."

He dictated the conditions, but it turned out they weren't enough for the machine--in a few seconds it demanded clarification and amplification from him.

While the "Intellect" chose the most profitable version for the housing authorities, E. Medvedev related how the system, composed of several series-produced computers, analyzers, and speech-synthesizers, had already become a reliable consultant for the ministry's leading specialists. In effect, the constructors had given each of them a "personal" electronic computer. What could be simpler-- just pick up the telephone and get the needed information. And if something has been omitted, the computer itself calls the executive and reminds him what still needs to be done; it prompts how best to act in the given situation. Of course, "Intellect" can also be reached by long-distance, which, incidentally, is already being done.

In order to see the latest novelty of the Minsk researchers at work, everyone had to leave the director's office and go to the machine room. There, department head Ye. Banetskiy, his deputy I. Khomitskiy, group heads V. Doroshchuk and G. Abrashkin, and engineer V. Matsatsa was teaching "Intellect" something hard for a machine--to read, recall, and produce drawings, plans, x-ray photos, oscillograms and other graphic images. In order to do this they had attached a semi-automatic ultrasonic apparatus, developed by an engineer from Novosibirsk, E. Skvortsov, to the electronic computer.

"Automating input of graphic information into the computer," explains Ye. Banetskiy, "is a pressing technological problem. The machine can work only with digits, but almost all research equipment outputs graphics, while designers produce drawings. Industry has begun to produce electromagnetic readers, but they are only good for straight lines."

Ye. Banetskiy took a lightpen and traced all the figures of the drawing with it. When the finished copy made by the graphics device was compared with the original it did not deviate by more than 0.1-0.5 millimeter. The engineers were happy with such precision, and they replaced the drawing with an x-ray image. Ye. Banetskiy explained:

"We made this version of the instrument at the request of doctors. With its help they intend to take the coordinates of tumors from x-ray photos and code them on punched tape in order to direct therapeutic radiation only at the infected area without touching healthy cells."

Automated input of graphic information into the electronic computer permits a qualitatively new level of utilization of computing equipment, transferring to the computer the entire design process. For example, it will be enough for an architect to draw a sketch of a building, and all the rest--the drawings, the calculations--will be done by the machine.

"We have already taught 'Intellect' a great deal; it has helped the administrative unit of the ministry free itself from a mass of routine operations, and the direct profit from its use today exceeds a million rubles a year," said the bureau's chief engineer, candidate of technical sciences V. Voinilo, as if summarizing all that we had seen and heard. "But we don't see our fundamental task even in this. We want to model the processes of a fifth-generation computer on the existing equipment, to create a machine prototype of human intellectual activity, to learn without any dictionary limitations, to speak as equals with the system."

WORK ON ROBOT EYES WITH PARALLEL PROCESSING OF INFORMATION

Vilnius SOVETSKAYA LITVA in Russian 21 Aug 85 p 4

NAUSEDAYTE, E.

[Abstract] The brief article reports on the development of electronic eyes
for robots at the Vil'nyus State University. It is recalled that candidates
of biological sciences V. Vanagas and D. Kirvyalis developed their first
robot eye five years ago. Their latest development reportedly is capable of
helping to guide a manipulator arm to an object located up to three meters
away. It is noted that the device will be turned over to the laboratory of
robotic systems of the Moscow Higher Technical School imeni Bauman. Other
robot eyes are being tested for use on production lines in industry. Vanagas
related that associates of the university's neurocybernetics laboratory are
working on parallel processing of visually recorded data for the robot eyes'
computer devices.

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MATHEMATICAL THEORY OF HOLOGRAPHIC MEMORY

KARASEV, M.V., MASLOV, V.P., Academician, Moscow Institute of Electronic Machine Building

[Abstract] Light waves are theoretically capable of recording octal inf a-tion, based on the dimensionality of the set of bicharacteristic equations of Maxwell and their invariant vector measures. However, the impossibility of recording the amplitudes and phases of wave trains from actual light sources reduces this number to six. Holography allows all six signal parameters to be recorded on a two-dimensional surface and later reproduced. This article refines this statement and demonstrates it mathematically. At pcints greater than a certain minimum distance from the surface of the hologram, the initial signal can be restored with accuracy equivalent to a certain complex factor and separated from the background for all orders of the short wave approximation. The amplitude, phase and polarization structure of the signal can take on any values. The reference wave is fixed, however. Complete restoration of signal polarization requires a known reference wave structure. References 6: 5 Russian, 1 Western.
[410-6508]

DEVICE FOR PROCESS CONTROL COMPUTER INFORMATION INPUT

CHERNYSHEV, V.I., Engineer, and LIMONOVA, M.Ye. and VAYSER, I.V., Candidates of Technical Sciences.

[Abstract] Devices are described for communications with controlled objects allowing the conversion of pneumatic signals from sensors to equivalent electrical information signals suitable for input to process control computers.

Control of switching devices through which information is passed from pneumatic sensors to the computer by the control computer itself can significantly reduce the number of pneumoelectric converters required. A method in which a sensor is connected to an individual converter and all input signals are compared with a common scanning control system in measurement cycle is also used. Both methods require that the control computer perform both control and communications with measurement devices. A better system is to distribute the switching and reading tasks to other controllers, which then communicate with the central control computer, relieving it of the task of controlling the measurement devices. Figures 3, references 7 Russian. [427-6508]

INK-JET PRINTING. METHODS OF IMPLEMENTATION AND AREAS OF APPLICATION

BEZRUKOV, V.I. and BRILLIANT, M.D., Candidates of Technical Sciences.

[Abstract] Ink-jet printing is generally recognized as the most important achievement of the past decade in the area of information recording. It is a child of jet technology and is based on jet control. It is simple in design, involves only one stage and consumes little power in the printing process, is highly reliable, fast and can be used on a great variety of surfaces. A description is presented of the ink-jet printing process, including discussion of factors limiting speed and image quality. Increased production of ink-jet printers in the USSR is suggested. References 5 Russian. [427-6503]

CONSTRUCTION OF ALGORITHMICALLY HOMOGENEOUS MULTIPROCESSOR SYSTEMS

VASIL'YEV, V.V., Corresponding Member, Ukrainian Academy of Sciences, and KUZ'MUK, V.V., Institute of Problems of Modeling in Power Engineering, Ukrainian Academy of Sciences.

[Abstract] Selection of the general structure of a modeling multiprocessor system involves: 1) determination of the most effective algorithms; 2) selection of the best structure for organizing the modeling system; and 3) determination of the language facilities to be used. The concept of homogeneous computer systems, structures and media is widely used in construction of

multiprocessor systems. This article suggests that algorithmic homogeneity of systems, structures and media be used in place of or together with structural homogeneity. This means the use of identical algorithmic facilities in constructing the structure of both modeling multiprocessor systems and multiprocessor systems being developed, parallel algorithms for their functioning and parallel programs. The use of identical algorithmic facilities for the construction of modeling and implemented multiprocessor systems, utilizing specialized language facilities, as well as parallel algorithms for the composition of specific parallel programs, allows the construction of algorithmically homogeneous computer structures, systems and media. The elementary processors or components might be microprocessors, microcomputers, minicomputers or large computer systems such as the YeS computers. The principle allows various computer facilities to be combined in a common work and allows their operation to be modeled in different, even dissimilar in terms of object, modeling multiprocessor systems. Figures 2, references 8 Russian.
[432-6508]

ORGANIZATION OF COMPUTER SYSTEM MAINTENANCE

KHOROSHEVSKAYA, E.G.

[Abstract] An evaluation is presented of the potential possibilities of organizing maintenance of a computer system, considered as a group of computers consisting of a large number of machines or processors, including a certain number of excess machines. It is assumed that the system performs jobs requiring parallel processing. An example is presented in which a system consisting of sixteen elementary machines is divided into five subsystems consisting of six, four, three, two and one machines. Figure 1, references 6 Russian.
[433-6508]

MODELING PROGRAM TESTING SYSTEM

KLIMOVICH, G.I., STEFANOV, A.M. and FOMENKO, I.M.

[Abstract] The mathematical models describing test objects based on LSI devices are complex structures with many dimensions. The problem of testing the adequacy of the mathematical models of these objects is therefore an important one. To test agreement between mathematical models and tested devices, a system has been constructed for testing modeling programs. The system consists of an ASVT M-6000 computer, a device for functional-static testing of logic units, an adapter and matching device. The correctness of modeling programs is tested by comparing values of output signals produced from the mathematical models on the ASVT M-6000 and the reaction of a standard test device connected to the functional-static testing unit. Figures 2, references 2 Russian.
[433-6508]

ORGANIZATION OF LOADING OF DATA INTO MULTIPROCESSOR COMPUTER SYSTEM MEMORY

KORYACHKO, V.P. and SUSKIN, V.V.

[Abstract] A study is made of a multiprocessor system with a common bus consisting of standard microprocessors and shared memory. The system also utilizes local memory for each microprocessor and an algorithm for loading of local memory with information required by each local microprocessor, thus reducing bus time consumption. An algorithm is developed for loading of local memory with intermediate data, constants and operands to decrease the number of times each microprocessor must access the shared memory over the system bus, thus increasing overall system throughput without adding more computing power. Figures 2, references 7 Russian.
[433-6508]

SELECTION OF OPTIMAL PERIOD FOR STORAGE OF INFORMATION WITH RANDOM INTERRUP-
TIONS OF A COMPUTATIONAL PROCESS

BRODETSKIY, G.L. and SHCHETININ, I.Ye., Kiev Construction Engineering
Institute.

[Abstract] A study is made of the problem of selecting the optimal period
for storage of information considering random memory failures in a control
system in which the decision to store information in more secure storage
devices is based on passage of a certain amount of machine operating time.
The model considers the increased probability of memory failure at times
when the system is interrupted for execution of higher priority processes.
References 5 Russian.
[432-6508]

METHOD OF DESIGN LAYOUT OF EQUIPMENT FOR MEASURING COMPUTING COMPLEXES.
CONTENTS AND CONDITIONS FOR INTRODUCTION

IVANOV, V.N., director, All-Union Scientific-Research Institute of Electrical
Measuring Instruments (VNIIEP), candidate of technical sciences; and
SOLOPCHENKO, G.N., candidate of technical sciences.

[Abstract] This paper is devoted to use of the method of design layout for
construction of measuring computing complexes (IVK). The IVK considered
are a means of measurement and a unified core of measuring information
sysems. Measuring, computing, and program components enter the composition
of the IVK, as well as means for generating signals to effect the objects
investigated. Measuring-computational complexes may have a multiprocessor
organization (including the use of processors of various types), and multi-
level architecture, including the presence of a control core and a combina-
tion of subordinate subcomplexes which take care of local problems, and
possibly some considerable distances away. The following items are considered
in detail: arrangements of IVK elements, designing of IVK, testing of IVK, and
organization problems. The general block diagram of a two-level IVK is
presented. IVK-15 and IVK-20 are mentioned. Figures 1; references: 15 Russian.
[426-6415]

ACOUSTICAL-OPTICAL PRESSURE TRANSDUCER

BUSRIN, V.I., candidate of technical sciences, GROKHOVSKIY, S.S., and
MILOVZOROV, O.V., engineers

[Abstract] The paper describes the sensor element of an optical pressure
transducer (OPT) and discusses the possibility of using this element for
measurement of acoustical pressure and ripple pressure. Here such a transducer
is called an acoustical-optical transducer based on the optical tunnel effect.
A figure presents the theoretical dependences of the reflecting power for
various units of the incidence of radiation and the experimental characteristics
of the OPT. The work was conducted at the Moscow Aviation Institute imeni
Sergo Ordzhonikidze. Figures 3; references: 4 Russian.
[426-6415]

INTERFEROMETRIC METHODS OF MEASURING INCREASED SENSITIVITY

SKOKOV, 1.V., doctor of technical sciences; and NOSKOV, M.F., engineer

[Abstract] The paper is concerned with methods and interference patterns (or
the compactness of darkening by an interferogram) and consequently to increase
the sensitivity of measurement without alteration of the method of investiga-
tion by an interferogram. Only universal methods adequately developed at
present are analyzed. It is possible to classify them arbitrarily into two
attributes (shown in a figure): 1: Physical phenomena causing the sensitivity
increase (multiple passage of the beam through the phase nonuniformity, use
of two wave lengths or nonlinearity of the process of registration of inter-
ferograms). The nature of processing the interference patterns (decrease
of "value" of the period of the bands or accentuation of the extremes of the
bands.   2) Methods making it possible to increase the sensitivity, only with
a solution of a limited range of the problem: for example, dispersion inter-
ferometry were not considered by the authors. Figures 9. References 53:
36 Russian, 17 nonRussian (1 in Russian translation).
[428-6415]

INFRARED RADIOMETER FOR DIAGNOSIS OF IMMERSIBLE ELECTRIC MOTORS

DENISOV, S.S., Candidate of Physical and Mathematical Sciences, MESHKOV, S.N., Engineer and STOROZHENKO, V.A., Candidate of Technical Sciences.

[Abstract] The method of thermal remote testing is applied to thermal diagnosis of immersible electric motors by development and manufacture of an experimental infrared radiometer consisting of a two-mirror spherical lens, disk modulator and drive, photoreceptor for IR radiation, electronic control unit, needle-type indicator and strip-chart recorder. The radiometer operates by receiving infrared radiation emitted by the object being tested in the lens, modulating the radiation with the disk modulator driven by the electric motor. The radiation is then sent to the pyroelectric photoreceptor, which develops an electrical signal whose amplitude is proportional to the power of the radiation received. The signal is amplified by the electronic unit and sent to the recording instruments. Testing of the IR radiometer immediately after a motor was switched on was shown to be able to detect overheating areas within 30 to 40 seconds. Figures 2, references 4 Russian.
[427-6508]

INTERFACING COMPLEX FOR PROCESS CONTROL SYSTEMS

Moscow LENINSKOYE ZNAMYA in Russian 14 Aug 85 p 3

[Text] A unif_ed electrical equipment complex that has been developed at the Cryogenic Equipment Research and Production Association will find use in machine building and the chemical industry, and in automated systems for the control of production processes. This electrical equipment complex is intended for the _.sk of interfacing automated control systems with production systems that have a large number of controlled parameters and actuating mechanisms. The complex has been designed so that it can be expanded when new types of components are used and when new problems are formulated for monitoring and controlling a facility.

The annual economic benefit from industrial introduction of the complex is 700,000 rubles.

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VIABILITY OF COMPUTER SYSTEMS

MELENT'YEV, V.A.

[Abstract] A study is made of the viability of computer systems, defined as the capability of the systems to continue performing their major functions or all functions, possibly with reduced effectiveness, following failure of some component elements. Equations are derived for determination of the minimum threshold of viability, i.e., the level of failures at which failure of one additional element will cause the machine to be unable to perform its major functions. References 10 Russian.
[433-6508]

MODELING AND AUTOMATIC SYSTEM DESIGN

ARAYS, Ye.A.

[Abstract] A description is presented of principles of modeling and automatic design of systems based on an expansion of the concepts of the theory of electronic circuits presented in previous works by the same author for heterogeneous hardware devices. The expansion of the theory is based on retrospective analysis of the component composition of a number of classes of devices. Classes include electronic devices, logic circuits, information systems, hydraulic systems and mechanical systems. The modeling and automatic design system has been used to generate a library of component models. Transition to a new branch of technology is performed by defining the component base and implementing the required model subroutines. In this way, a language is formulated for description of the new class of technical devices. The purpose of development of the modeling and automatic design system was to construct a rather general and flexible computational apparatus to support modeling of a broad range of multicomponent hardware devices. Figures 3, references 16 Russian.
[433-6508]

SOFTWARE

TRANSLATION OF ALGOL PROGRAMS TO PARALLEL PROGRAMS

KOLESNIK, A.M. and SHKUT, N.V.

[Abstract] A study is made of the problems of applying a process for creating parallel programs to the translation of programs originally written in the language ALGOL-60, with the following distinctions: side effects and recursive procedures are forbidden; structured use of transition operators is required; operations on files and re-entrant procedures are defined; means are implemented for assigning parallelism of operators and describing control structures for the performance of operators. The plan suggested for translation of ALGOL programs to parallel programs has been implemented as a functional expansion of the programming system ALGAMS for the YeS computers running OS at the Institute of Mathematics, Belorussian Academy of Sciences.
References 8 Russian.
[415-6508]

METHOD OF FORMING SYSTEMS OF PARALLEL PROGRAMS

TYULYAYEVA, V.V.

[Abstract] An algorithm is suggested for solving the problem of forming parallel branches to minimize the time required to run a program. This is achieved by increasing the time of parallel computation and decreasing the time of communications among parallel branches. The algorithm for formation of parallel program systems consists of the following steps: 1) division of texts of programs in the linear segments and numbering of the segments, including determination of the input and output parameters of each linear segment; 2) selection of sets of information-independent linear segments; 3) testing of fulfillment of necessary scientific conditions for paralleling;

4) formation of the initial parallel program system; and 5) changing of the
system to improve performance.
[416-6508]

DEVELOPMENT OF SOFTWARE FOR 'ELEKTRONIKA S5' MICROCOMPUTER BASED CONTROL SYSTEM

OGORODNIKOV, A.A. and BITYUKOVA, L.N.

[Abstract] A description is presented of the development and debugging of
software for multiprogramming real time systems based on the 'Elektronika
S5-11' microcomputer. Primary attention is given to description of the
supervisor and debugging systems, which could be widely used in the development
of software for later models of microcomputers as well. The systems developed
are distinguished by their simplicity of implementation and small memory
requirements. The supervisor and debugger described and program development
methods utilized in developing the software system are recommended for the
development of various real time systems for other computers in the same
family. The supervisor is intended to organize the functioning of multipur-
pose real time systems performed by the 'Elektronika S5' single-board micro-
computer family. The supervisor supports both interrupt-driven and clock-
driven processes. The supervisor is called by clock-generated interrupts and
must have a higher priority (of the eight priorities possible in the computer)
than the user tasks running. Figure 1, reference 1 Russian.
[433-6508]

APPLICATIONS

DETERMINATION OF SIMILARITY OF TWO GRAPHIC REPRESENTATIONS BY MEANS OF
HAUSDORF DISTANCES

KRUPKA, I.N., PETUNIN, Yu.I. and PETUNINA, M.Yu.

[Abstract] Certain pattern recognition and processing problems lead to the
statement of the following problem: suppose G and F are two limited convex
areas on a plane; determine the distance rho(G,F) between figures G and F
such that it characterizes the degree of mismatch of the shape and position
of these figures on the plane. The method was used to solve the problem of
planning radiation therapy for throat cancer, which requires estimation of
the similarity of location of the malignant tumor of the patient to be
treated for which this type of radiation led to a positive therapeutic effect.
References 3 Russian.
[415-6508]

WORK ON PUTTING COMPUTER AND CRTs IN AIRLINER CONTROL PANELS

Moscow VOZDUSHNYY TRANSPORT in Russian 17 Aug 85 p 3

A: Tseyukov , V., correspondent (interviewer)

[Excerpt] I visited a laboratory of the ergonomics department of the State Scientific Research Institute of Civil Aviation.

"What kinds of technical innovations are pilots waiting for, and what will the controls of airplanes of the near future look like?" I asked V. Kuznetsov, senior science associate of the institute's engineering-psychology research sector.

"There will be far fewer electro-mechanical devices in them," said Valeriy Mikhaylovich. "Such devices and several dozen dials and lights will be replaced by the screen of a cathode-ray tube. The development of this kind of integrated information-signaling system is now in progress."

"For what purposes is the new system intended, and what will pilots gain from it?"

"At the present time, with aviation technology advancing rapidly, aircraft systems are becoming more complex, and the most important ones have back-up systems. It is not easy for a pilot to control an aircraft and interact with instruments and indicating devices.

"The new system is called upon to help pilots. It will make it possible to remove a portion of the devices that are located directly in front of the pilot, and to remove all the devices from the flight engineer's panel. Needed information on the operation of all of the airplane's maintenance systems and several of its main units will be 'concentrated' in a single place--on the color screens of cathode-ray tubes in the center of the instrument panel.

"The use of a digital computer will help to lower stress on the pilot and heighten his efficiency. Equipment failures will be analyzed automatically, and the urgency of the situation will be taken into account in the process; i.e., the new system will select and issue the most significant information at the most difficult moments of a flight, while information of secondary impor- tance will be issued after the main problems have been taken care of."

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"Data on a television screen will take the place of instrument readings and warning lights, and the volume of information will increase. But what about psychophysiological stress?"

"The point is that information will appear on the screen only as needed by the pilot, in accordance with the condition of systems and with specific stages of the airplane's flight--whether it is taxing, climbing, approaching for a landing, etc. These data will be issued automatically in line with a program; in all other cases, it will remain possible for the crew to conduct an active dialog with the system, in which necessary information can be called up on the control panel at any moment."

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FORMATION OF PRICES FOR DESIGNS OF AUTOMATED TECHNOLOGICAL PROCESSES CONTROL SYSTEM (ASU TP)

GORNSHTEIN, M. Yu., candidate of technical sciences, SULMAN, L.A., candidate of technical sciences; LYTNYA, T.F. and FIDEL, E.L., engineers

[Abstract] The paper considers the methodological bases for the formation of the prices for designs of an automated technological processes control system (ASU TP), including formation of the principal requirements on prices, establishment of factors determining the labor input and cost of development of ASU TP designs, the arrangement for their accounting, and the method of establishing prices for ASU TP designs. Detailed tables are presented for the following: 1) Results of calculation of value factor for the technical assignment and divisions of the ASU TP design; 2) Correction factors and established prices in the area of their use; and 3) Allocation of prices for two-stage development of divisions of ASU TP design at design stages. The methodology called "The Temporary Price List for the Development of ASU TP Designs," has been worked out by VNIIPISAU [All-Union Scientific Research and Design Institute of Automation and Control Systems] (Moscow) and TsNIIKA [State All-Union Control Scientific-Research Institute of Integrated Automation], and was approved by Minpribov and the GKNT. Tables 3; references: 5 Russian. [426-6415]

DIGITAL ROBOT ENGINEERING SYSTEM ADAPTIVE CONTROL AUTOMATA

TIMOFEYEV, A.V., Doctor of Technical Sciences

[Abstract] A description is presented of the experience gained in developing software for adaptive digital control automata for a broad range of robot engineering systems utilized to automate technological processes. The

effectiveness of the digital control automata is illustrated by experimental results involving modeling and testing of specific robot systems under both laboratory and factory conditions. Problems related to automation of planning and multiprocessor implementation of the digital automata are also discussed. Figure 1, references 8 Russian.
[427-6408]

AUTOMATION OF PROCESS OF DUST REMOVAL FROM MINE AIR USING PNEUMATIC AUTOMATION DEVICES

KUPRIYANOV, V.V. and ZASUKHIN, I.N., Candidates of Technical Sciences.

[Abstract] The most widely used method of dust removal from mine air is creation of a water fog by means of pneumatic sprayers. The foggers are periodically switched on as a function of the dust content of the air. This article describes an automatic system to support dust removal in a mine based on pneumatic automation equipment. A pneumatic system is used to measure the content of dust and control the fogging equipment. The pneumatic dust content measuring system is said to achieve an accuracy of 6%. References 2 Russian.
[427-6508]

ONE ALGORITHM FOR PATH SELECTION

NOGOVA, Ye.G.

[Abstract] An algorithm is described for selection of optimal paths to be followed in delivering large numbers of people to and from mass events. The method, based on successive approximations, involves a process of fixing a constant path which will have the maximum number of passengers, eliminating that path from the set of available paths, then repeating the cycle until all travel demands are satisfied. The algorithm for constructing systems of constant routes was implemented in a FORTRAN program and tested by designing bus routes for the city of Alma-Ata, a task which required two minutes of M4030 computer time. References 2 Russian.
[433-6508]

MODELING OF EARTHQUAKE STRESSES ON STRUCTURES MERITS PRIZE

Kishinev SOVETSKAYA MOLDAVIYA in Russian 20 Aug 85 p 3

Onofrash, N., head of a laboratory of the Moldavian Academy of Sciences'
Institute of Geophysics and Geology

[Abstract] The author comments on the background and significance of a work
entitled "Development and Introduction of Theoretical and Experimental
Methods for Studying Physical-Mechanical Properties of Materials and of Struc-
tures Made of Them." The work was done under the direction of Doctor of
Technical Sciences, Professor Ye. L'vovskiy. The author endorses its
nomination for the Moldavian SSR State Prize.

The results of the work are said to provide a number of advantages for
designers who use mathematical modeling and computer experiments in evaluating
dynamic reactions of structures to the effects of earthquakes. The author
explains that L'vovskiy's group succeeded in developing a universal metho-
dology for forecasting the dynamic state of mechanical systems. Every stage
of the methodology is fully automated with packages of computer programs, and
specific recommendations have been provided for application of the methodology.
It makes it possible to take a new approach to analyzing the stress-deformed
state of structures, and to make costly experimental studies more efficient,
according to the author. Design models can be approximated as closely as
possible to full-scale ones.

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PROBLEM OF FORMING GEOLOGICAL-GEOPHYSICAL DATABASES

LOMTADZE, V.V., 'Irkutskgeofizika' Production-Geophysical Association.

[Abstract] The Codasyl concept is unsuitable for storage, retrieval and
processing of geological and geophysical data files. File-oriented databases
developed for geological and geophysical applications are analyzed. The file-
oriented database structure suggested has been successfully used at the
author's association to create regional databases for the territories in which
the association is active. Software systems have been developed to support
the database. The data operating system includes programs for the formation
of temporary databases from regional databases, compression of regional file-
oriented databases and presentation of results. It is suggested that the
territory of the Soviet Union be distributed among regional computer centers,
the thesaurus developed at the author's association be expanded and standard-
ized and that the organization of data be standardized within the framework
of file-oriented databases, defining for each geological-geophysical method
types of files to be transmitted to the regional databases. The described
approach is being used successfully by the Irkutskgeofizika Association.
Several programs (SOD, KOMPAS, GRAVIPAK) have been translated for use with
OS YeS for this purpose. References 6: 5 Russian, 1 Western.
[422-6508]

LOW-TURBULENCE WIND TUNNEL; MINICOMPUTER "SEVER" FOR CAD

Moscow PRAVDA in Russian 19 Aug 85 p 7

[Text] Scientists of the USSR Academy of Sciences' Siberian Branch are doing research on problems of science with importance for the present. At the Institute of Automation and Electrometry, a system for automated designing on the basis of the super-minicomputer, "Sever" is being developed.

And at the Institute of Theoretical and Applied Mechanics, tests of models that will become machines of the future are being conducted in a low-turbulence wind tunnel.

(Two photographs show senior project engineers S. Shemetov and Ye. Yurashanskiy at work on adjusting the minicomputer, and an airplane model being set up inside the wind tunnel.)

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LEADER OF WORK ON AUTOMATION OF RESEARCH ASSESSES PROGRESS

Riga SOVETSKAYA LATVIYA in Russian 23 July 85 p 2

Ovcharov, V. (Moscow)

[Excerpt] "The goal of comprehensive automation of the economy is one of the most important principles of the scientific-technical policy of our Party and state," said Doctor of Technical Sciences, Professor A. Vystavkin, head of the scientific-methodological center for automation of scientific research at the USSR Academy of Sciences' Institute of Radio Engineering and Electronics, in a conversation with a TASS correspondent. "Special emphasis was placed on the significance of this at the April (1985) Plenum of the Central Committee of the Communist Party of the Soviet Union, and at the recent conference in the Central Committee. The goal requires first of all that the latest computer technology be put to work in all spheres of activity that determine technological progress.

"As for the need for intensification of basic science, it results from both the broadening of the range of research and the growing complexity of research.

"As more and more research activity becomes automated, the task arises of developing universal interface technology, that is, apparatus which connects computers with experimental and industrial units, as well as universal software to control this apparatus. Of all the standards for such apparatus, the well-known CAMAC international standard has been the most broadly employed in our country since the mid-1970s.

"Systems developed on the basis of this standard have a modular structure and possess flexibility and the necessary speed, as well as other merits. With the aid of these systems, grandiose experiments have been performed using such highly sophisticated instruments as the world's largest radio telescope, the Ratan-600; a counter-beam accelerator-accumulator complex; units with MHD generators for geophysical research; and a system for constructing radar representations of the planet Venus.

"Methods and equipment tested for purely scientific purposes have proved valuable also in the development of industrial systems, particularly ones for automating production processes, testing prototypes of new technology and assuring product quality. Such systems have been introduced at the Volga

Automotive Plant, the Siberian Casting Machine Plant in Novosibirsk, and a number of radio plants, for example.

"What has been accomplished is clearly not enough, however," said the scientist in conclusion. "The question now is one of stepped-up introduction of what has already been developed, development of improved and more economical systems, and employment of qualitatively new methods in research practice, on the basis of automation. Certain difficulties exist here. The scientific-methodological center for automation of scientific research which has been created at the USSR Academy of Sciences' Institute of Radio Engineering and Electronics has the mission of uniting the efforts of scientists, engineers and designers."

I. OPTIMIZATION INTERBRANCH INTERREGIONAL MODEL AND ITS IDENTIFICATION

GERASIMOV, Yu.K.

[Abstract] A nonlinear optimization interbranch interregional model is constructed in the form of an optimal control problem, and methods of its approximate identification are studied. Multibranch models of this form have been described in previous articles, which have assumed that the technological coefficients are known over the period of the plan. This limitation is not applied in the present article, making it in effect a method of optimization of technology. The linear programming solution of the problem is unstable. The model is oriented toward the so-called effective path of economic development, which has the property of stability. References 7 Russian. [415-6508]

EFFECTIVE APPROXIMATE ALGORITHM FOR THE GENERAL PROBLEM OF SCHEDULING THEORY

BELETSKIY, S.A. and LEVENTAL', V.Ts., Institute of Cybernetics imeni V.M. Glushkov, Ukrainian Academy of Sciences, Kiev.

[Abstract] A study is made of the following problem of scheduling theory: suppose there are s types of identical machines. M_i represents the set of machines of one type. For each K parts a technological path has been assigned, i.e., a sequence of operations required for its manufacture. D represents the set of operations equal to the union of the sets of operations for processing of all parts. The problem is to minimize the calendar time required to manufacture the entire set of parts. This represents an expansion of the Johnson problem to the case of multiple identical machines for the individual

operations required. An algorithm is developed which is useful for either manual or computerized solution and allows operations on paths to be performed in parallel by several machines. References 6 Russian.
[420-6508]

PROBLEM OF WAVE FIELD CONTROL IN ACOUSTICALLY HETEROGENEOUS MEDIUM

BURDO, O.S. and DARGEYKO, M.M., Institute of Cybernetics imeni V.M. Glushkov, Ukrainian Academy of Sciences, Kiev.

[Abstract] The problem of controlling processes in complex media is closely related to problems of identification of the parameters of a medium. Active plasma diagnosis, probing of the upper layers of the atmosphere or depths of the ocean utilize wave fields of varying physical natures. This article studies the problem of localizing of a field at a fixed point in a multimode acoustically heterogeneous medium on the assumption that the parameters of the medium are known. The solution of the problem of radiation in wave guides is significantly more difficult than in free space. Therefore, the authors base their studies on the principle of phase conjugation, widely used in the planning of optical and electronic systems. Numerical modeling is used to analyze the applicability of the method. The calculations for the case of a heterogeneous medium without absorption show the possibility of focusing on acoustical field on a fixed point in space, though this greatly increases the requirements on resolution of the system. Figures 4, references 4 Russian.
[421-6508]

ASGA-T MOTOR VEHICLE ENGINE EXHAUST GAS ANALYSIS SYSTEM

GRIMISKIY, V.F., Engineer

[Abstract] The ASGA-T stationary motor vehicle exhaust gas analysis system can measure the concentration of CO and CO_2 total hydrocarbons as methane, and oxides of nitrogen as NO. A table lists measurement ranges and errors. An infrared absorption method with optical-acoustical detector, flame- ionization and chemiluminescent methods are used. The ASGA-T has completed testing and has been in series production since 1983. It is the first such device produced in the USSR. References 2 Russian.
[427-6508]

PROGRAM PROVISIONS FOR INTEGRATED TRAINING SIMULATORS

IOVENKO, O.V., candidate of technical sciences

[Abstract] The paper is concerned with USSR and foreign integrated training
simulators used in the process of training operational personnel of atomic
and thermal electrical stations. These trainers make up a system which includes
educational methods, hardware and software. The generalized structure of the
software of integrated full-scale training systems is shown and its standard
and nonstandard parts are considered. It is concluded that the program pro-
visions of the trainers are a fairly complex system which requires substantial
means and efforts for development. At present a number of trainer projects
exist in which there are means for automation of the development of software.
It is possible to attain a decrease of the expenditures for development of
trainer programs by use of standard general-purpose operating systems with
real time performance, effective systems of control of the basic data of the
trainers, specialized building by means of development and check-out of pro-
grams, libraries of correlated and standard modelling programs, and high-level
languages. Figures 1, tables 1, references 12: 2 Russian, 10 nonRussian.
[428-6415]

THEORY OF COMPUTATIONS

SELECTION OF KINEMATIC PARAMETERS AND EQUATIONS OF ROTATION FOR NUMERICAL
INTEGRATION BY DIGITAL COMPUTER

PANOV, A.P., Institute of Cybernetics V.M. Glushkov, Ukrainian Academy of
Sciences, Kiev.

[Abstract] One means of increasing the effectiveness of utilization of computers
in calculating the parameters of orientation in cases of meausrement of
angular velocities or quasicoordinates of a solid is to decrease computa-
tional complexity of the methods used to determine orientation parameters
while maintaining the required accuracy of computation. Among orientation
parameters known in mechanics of the greatest practical interest for organ-
izing computational processes in digital computers are direct cosines,
Rodriguez-Hamilton parameters, the coordinates of the vector of final rotation
and coordinates of the so-called orientation vectors. These parameters were
selected in this work for analysis of the requirements of simplicity and
reasonable accuracy. New vector rotation parameters with a number of peculiari-
ties in comparison to the known parameters are also analyzed. The brief analy-
sis of orientation parameters and kinematic equations of rotation shows that
from the standpoint of satisfying the requirements of simplicity and accuracy
the Rodriguez-Hamilton parameters and corresponding kinematic equations are
optimal. References 10: 9 Russian, 1 Western.
[421-6508]

DESCRIPTION AND COMPUTATION OF PARAMETERS OF SPIRAL MOTION OF A SOLID BODY

LEBEDEV, D.V., Institute of Cybernetics imeni Glushkov, Ukrainian Academy of Sciences, Kiev.

[Abstract] A dual analogue of the vector parameter of a three-dimensional rotation group is used to describe the three-dimensional motion of a solid. Logarithms are presented for computing the parameters of spiral motion of a solid based on observable integral information on the evolution of the object. The applicability and effectiveness of the algorithms developed are tested for a particular case of motion of a solid. Four versions of algorithms for calculation of motion characteristics were tested. Figure 1, references 9: 8 Russian, 1 Western.
[421-6508]

DEVELOPMENT OF COMPUTER-AIDED INSTRUCTION IN GEORGIA

Tbilisi ZARYA VOSTOKA in Russian 31 Jan 85 p 4

[Article by Dali Sadatierashvili, "Still another 'Profession' for the Computer"]

[Text] One of the basic tasks set by the school reform
for the system of popular education is to equip students
with the knowledge and skills for using modern computing
equipment and insuring the wide utilization of computers
in the educational process.

The terms "computer," "display," and "electronic computing machine" have
firmly entered and become fixed in our everyday lexicon, although for the most
part they are used as technical jargon by members of certain professions.
Recently, teachers have joined this group.

A computer classroom. An automated physics course is being tested. On the
screen is a problem, illustrated by a diagram. The student, using the
machine's alphanumeric keyboard instead of a pencil, inputs the answer he has
formulated. The first try. On the display: "Incorrect. Try again...." In
this way the dialog between the computer and the student, which consists of
questions leading towards the correct solution of the problem, continues.
Methodically and expediently, the machine explains each mistake made by the
learner as if it were the teacher. Over and over the computer suggests
another attempt to solve the problem. And the problem is really solved. On
the screen appears "Good boy! The solution is correct. You may go on to the
next problem."

These are the kinds of "dialog-lessons" being conducted with students from
the 1st, 27th, 42nd, 37th and 53rd Tbilisi secondary schools in the Republican
Ministry of Education's Main Computer Center. The computer classroom set up
here is a model for school classrooms of the time when computers will have
found broad use in the educational system. And meanwhile work creating auto-
mated testing-and-learning courses and their testing is going on here.

The most varied specialists, experts in the subject areas, specialists in
teaching methods with experience working in the schools, programmers,
psychologists and others, take active part in this work. Programmed-instruction

courses in phsyics for the eighth and ninth grades, in mathematics for the
sixth and seventh grades, in the English and Russian languages for the
fourth grade, as well as game teaching-intelligence programs, aimed at develop-
ing the students' logical thinking and producing the maximum attentiveness in
various game situations, have already been worked out.

An automated course is a complex man-machine system in which the controlling
object is human cognitive activity.

"The automated courses we have developed," explains Giya Gvaramiya, the
director of the Main Computer Center of the Georgian Ministry of Education,
"are basically intended to accustom the students to computing equipment, and
also to repeat, reinforce and systematize course material. With this approach,
it is unnecessary to make up courses on every point of the textbook; it is
enough to illuminate the key, most difficult and fundamental of its sections.
(for understanding, mastery, drill, etc.) Experiments have shown that the most
difficult-to-overcome barrier in the path of the mass use of automated courses
is the difference between the individual character of the student's work with
the computer and the traditional (group) form of education in the school.
Here it is necessary to achieve, in our view, a united interpretation of the
forms of use of such courses in combination with the forms of education and
testing of knowledge in the school. All this must be realized in cooperation
with teachers, psychologists, doctors, and the courses' immediate designers.

The practical experience accumulated in the computer center in the process of
testing automated courses has shown that one form of work with computers--the
paired one--can play a substantial role in overcoming this barrier, since
during the lesson period the students help each other, which, in turn, undoubt-
edly increases their cognitive activity.

"The kids are happy to come here," says the director of the department of
automated teaching systems of the Ministry of Education's Main Computer Center,
Aleksandr Eligulashvili. "Obviously, they're interested in the work. Some-
times, as they say, you can't tear them away from the display. In my view,
the combination of the enjoyable with the useful is very successful. I think
that quite soon the completely natural necessity for a broader use of the
automated courses we have developed in the educational process will be created."

In the near future, when computer control of various production processes in
all areas of the country's economy becomes still more widespread, the need
for trained programmers will significantly increase. Therefore, today ninth-
graders from 26 of Tbilisi's secondary schools each week take laboratory and
practical lessons conducted with the equipment of the branch computer centers
of various ministries and departments of our republic. The Georgian SSR Minis-
try of Education guides the methodology of the lessons. Such lessons have been
introduced in the syllabi of the republic's general-education schools in the
framework of work instruction.

A great deal of painstaking work lies before the staff of the republican
Ministry of Education's Main Computer Center. There are the most varied plans
for the future: the creation of an automated physico-mathematical encyclopedic

dictionary, a library of automated programmed-learning, physics, mathematics, foreign-, Russian-, and Goergian-language courses, as well as a "data bank" for preserving the "history" of the students' progress through the automated courses on microcomputers, etc. And already the first trial attempts at computerization of the learning process have shown that the computer's new role, that of active assistant to the school teacher, will be fated to be firmly assigned to it in the future.

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INFORMATION RETRIEVAL FOR EDUCATIONAL INFORMATION

Moscow PRAVDA in Russian 13 Aug 85 p 3

[Article by V. Mislavskiy, Candidate of Pedagogical Sciences: "The Teacher and the Computer: School on the Paths of Reform"]

> [Text] PRAVDA previously reported about the progress of the preparation for introducing the basics of informatics and computer technology into the educational process in schools. Today's publication is more about one aspect of this problem. The topic discussed is the use of computers to assist in the self-education of the teacher in order to improve his qualifications and pedagogic skills.

With the complication of the task of Communist education and the rapid growth of science and engineering, the amount of information intended for school teachers and instructors has grown significantly. With traditional forms of providing information and because of their extensive duties, teachers cannot adequately assimilate the constantly growing flow of educational information that is accumulating as a result of scientific studies and progressive experiments.

Sociological studies show that most teachers subscribe to and constantly use specialty methods journals, but that general pedagogic publications and special pedagogic and psychology books are read by only a small portion of teachers. Twenty years as a school principal convinced me of the truth of this. Moreover, the complexity of the tasks of molding each school child into a comprehensively educated person and the characteristics of the present riding generation require from the teachers and parents a more skillful approach to the education and training of children and young people.

These circumstances dictate the necessity of changing and improving the scientific-pedagogic information system for teachers, especially in the areas of the theories and methods of Communist education, and of making it accessible, timely, and widespread. It is not possible to solve these problems without using modern computer technology. The topic of discussion here is the wide use of computers and programming methods for developing automated information-retrieval systems (AIPS), which make possible the accumulation, storage, retrieval, and high-speed output for inquiries submitted by teachers in regard to specific scientific-pedagogic information situations.

Such an experiment was carried out in Moscow on the basis of the main computer center of the "Gidroproyekt" Institute. The sphere of information to be provided was the area of educational interactions between the school and the family. The variant of the AIPS developed and given the nominal designation "Teacher-parents" assists the classroom teacher in obtaining, with a minimum expenditure of effort and time, data characteristic of a specific family and the pedagogic information needed for organizing the interactions with the parents.

To use the computer, the teacher fills out blank punch cards which are sent to the computer center. The informational material provided consists of advice to the teacher and lists of recommended literature. Having been previously coded and transferred to punch cards, this material is recorded on magnetic tape, which is kept at the computer center.

The textual information obtained from the computer corresponds to real-life situations that are of interest to the teacher. This information recommends definite pedagogic action, indicates the suitability of the form and method of contact for a particular situation, recalls the rules of professional tact, and cautions against typical mistakes. The final word is always the teacher's, and he alone in the final analysis must determine the scope and method for these tasks.

The use of similar AIPS is possible in quite different spheres of pedagogic activities. Thus, knowing the most complex parts of an educational program and the characteristic difficulties in the teaching of a subject, information-retrieval systems can be set up for all subject areas in the curriculum of a general education school. It is advisable to do this after years of teaching the subject and to store for the teacher not only advice concerning teaching methods but also different kinds of didactic material.

Also included are the prospective setting up of AIPS for: pressing problems of school administration and supervision (to assist the school principal and his assistants); various forms of out-of-school educational activities; problems of teacher-student contacts; the subject matter and methods of conducting elective classes; the organization of school activities and the activities of after-hour groups; the interactions of the teacher with self-governing student organizations; and others.

The high quality of information, built into the information retrieval system, will be ensured by the fact that the development and establishment of recommendations intended for teachers and administrators will be handled by the scientific-research institutes for pedagogic specialties; by the corresponding departments in universities; by pedagogic institutes and departments for raising the proficiencies of principals of secondary general education schools; and by experimental methodologists of institutes for the improvement of teachers.

Active participation in the organization and operation of the new information systems will require from pedagogic scientific-research institutes and departments of higher institions of learning a thorough systematic analysis of school

practices and a definite restructuring of their work, the most serious being orientating it towards the vital requirements of the schools and the needs of the teachers. This will help to bring pedagogics closer to life and to introduce the advances of psychologic-pedagogic sciences and the foremost knowledge into the general education school practice.

Information-retrieval systems based on computers have sufficient capacity, flexibility, and mobility; the number and scope of social-psychological factors that characterize any pedagogic situation will vary according to the components. The introduction of AIPS to assist teachers in the form of supplementary scientific-pedagogic information does not require the installation of special computers in all schools, districts, or city branches of public education. It suffices, if one is concerned about that, to have one computer center in each oblast, kray, and autonomous republic. The computer centers belonging to the oblasts and krays and specified types of computers at pedagogic institutes and universities can be used for this purpose. The universal character of information-retrieval systems makes possible their wide usage; a teacher living in a rural location can send inquiry cards to the appropriate computer center and obtain the answer by mail.

Naturally, all of this work assumes the organizational and scientific-methodological leadership on the part of the USSR Ministry of Education and the Academy of Pedagogic Sciences. The introduction of new systems of providing information using computers will assist teachers to successfully solve the complex problems of training and teaching young people in the light of needed reforms in general education and professional schools.

ORGANIZATIONS

COMPUTER INSTITUTE REDEFINES GOALS FOR PARTY'S TECHNOLOGY DRIVE

Moscow EKONOMICHESKAYA GAZETA, No 27, Jul 85 p 8

Prokhorov, N., director of the Institute of Electronic Control Machines

[Abstract] The author reports that executives and Communist Party officials
of his institute recently held a meeting to discuss the role of the institute
in the light of tasks stemming from the Communist Party Central Committee's
conference on accelerating technological progress. Since the Party conference
called microelectronics and computer technology a catalyst of technological
progress, and the institute develops control data-processing machines of the
system of small computers (SM EVM), the author reports that the institute's
scientific-technical council now is reviewing and redefining the main direc-
tions of its work.

It is said that in general, efforts are to be focused on heightening the quali-
ty, reliability and economy of computer equipment. The institute hopes to in-
crease the share of products it has developed which are produced with the
Seal of Quality above the present level of 75 percent. It plans to develop
machines to fully meet the needs for computers in such applications as automa-
tion of production processes and equipment, automation of scientific research
and design work, and automation of management of production and of industries.
Improvement of quality and reliability will be pursued through standardization
of computer hardware.

The author also reports that concepts for the development of computer tech-
nology in the period 1986-1990 and a corresponding R&D plan currently are being
formulated at the institute. They call for incorporating the latest achieve-
ments in microelectronic components. It is said that in long-range develop-
ments, the institute is setting sights on accomplishing data processing in
natural form, such as speech and real pictures.

In conclusion, the author reports that the computers which the institute
develops are manufactured at 12 different plants, including the Lithuanian
production association "Sigma".

POLYTECHNICAL INSTITUTE'S AUTOMATION R&D COMPLEX AIDS INDUSTRY

Moscow IZVESTIYA in Russian 13 Aug 85 p 3

Yampol'skiy, V., Professor, director of the educational, research and production complex "Kibernetika" of the Tomsk Polytechnical Institute

[Abstract] The author discusses the work of the Tomsk Polytechnical Institute's combined educational, research and production complex "Kibernetika", which he says represents a progressive organizational form of making the educational and research resources of higher schools available to industry.

Organized as one of the first such complexes in the country in 1976, "Kibernetika" is said to have become essentially an institute within the polytechnical institute, operating with its own charter approved by the Russian republic's higher e ucation ministry and possessing its own finances. The complex takes in the polytechnical institute's school of automation and computer technology, and a computer center, and it has a large research division which includes several laboratories that are operated jointly with industries. About a hundred doctors and candidates of sciences reportedly work in the complex's departments and laboratories. An annual volume of 3.5 million rubles of R&D work is done on fundamental and applied problems of automation. The complex also helps to train nearly 2,000 of the institute's students in such fields as computers, robotics, automated information systems, process control systems, and automation of research and design work.

The author describes the advantages of the complex in helping the institute to respond quickly to industry's needs for staffing new kinds of specialties. He says it has instituted new training programs at industry's requests without having to wait through the long process of ministerial applications and approvals that is customarily involved. The complex also operates a school for advanced training of scientists who work in Tomsk and other cities of Siberia.

It is mentioned that many of the complex's graduates work at the "Kontur" association, which makes numerical control devices for machine tools.

PUBLICATIONS

SYNOPSES OF ARTICLES IN AVTOMETRIYA, No. 3, MAY-JUNE 1985

Novosibirsk AVTOMETRIYA in Russian No 3, May-June 85 pp 105-106

PRODUCING A PLANIMETRIC PLOTTING OF TWO DIMENSIONAL OBJECTS BY MEANS OF NON-LINEAR OPTICS METHODS

[Synopsis of article by K. I. Samaria]

[Text] Examines the possibility of obtaining an image outline on the basis of a quadrupole non-linear frequency conversion in isotropic media. Calculates a method for an image of a homogeneously illuminated half-plane projected onto a non-linear medium. Estimates of the energy parameters of the contour image output illumination are obtained. Bibliogr. 12.

BRIGHTNESS AMPLIFIER OF AN INFRA-RED IMAGE ON LINES OF NEUTRAL XENON WITH $\lambda = 3.51\mu$

[Synopsis of article by A. G. Verkhoglyad, Yu. P. Kuleshov and P. F. Kurbatov]

[Text] Determines the optimum amplifier parameter values from the point of view of obtaining the maximum amplification coefficient. The dynamic range and noises of an amplifier are measured. A real solution of an amplifier is obtained. Illustr. 10, bibliogr. 15.

PARAMETERS AND PROPERTIES OF MAGNETIC DEFLECTION SYSTEMS FOR ELECTRON BEAM DEVICES

[Synopsis of article by Z. D. Gritskiv]

[Text] Proceeding from the problems of comparing magnetic deflection systems at the stage of their development, of production control, of the formulation of the technical assignment in development, an attempt at systemization of parameters is made. It gives a practical, full enumeration of parameters,

divided into three basic groups: electrical, electron-optical, and design. Establishes a selection of parameters such as coupling coefficient, deflection sensitivity, efficiency, and efficiency coefficient. Classifies characteristics of systems. Tables 1, bibliogr. 9.

UDC 621.3.032.36

NEW TRENDS IN THE DEVELOPMENT OF A PARAMETER SYSTEM FOR ELECTRON BEAM RECEIVING DEVICES

[Synopsis of article by T. M. Duzhii, V. V. Pigrukh, M. I. Reznik]

[Text] Gives experimental results on the properties of high-informant pipes screens, operating in a current beam of large densities; analyzes basic phenomena arising upon luminophores saturation. Proposes the introduction of parameters characterizing exhaustion: saturation depth, limiting scanning velocity, and modulated saturation and persistence properties. Tables 2, illustr. 4, bibliogr. 4.

UDC 621.317:519.21

AL ALGORITHM FOR SOLVING THE WEINER-HOPF SYSTEM OF INTEGRAL EQUATIONS USING A MODIFIED METHOD OF UNDETERMINED COEFFICIENTS

[Synopsis of article by M. G. Zotov]

[Text] In the undetermined coefficients method the basic complexity is the difficulty of determining the antecedent structure of the solution matrix elements. A simple solution algorithm for this problem is set forth. Illustr. 1, bibliogr. 3.

UDC 519.24

IMPROPER PROBLEMS IN THE SPECTRAL ANALYSIS OF STEADY-STATE RANDOM PROCESSES

[Synopsis of article by E. L. Kuleshov]

[Text] Evaluating a steady-state random process spectral density according to the execution of a finite duration results in improper problems, for which normalized solutions are found and a correspondence with conventional nonparametric spectral evaluations, based on the application of smoothing windows, is established. Defines a connection between the regularization parameter and the duration of the observation interval. Obtains optimal spectral evaluations which generalize the famous Lomnitskiy and Zaremba solution. Bibliogr. 5.

EVALUATING THE MOMENT OF STATE CHANGE OF A MECHANICAL SYSTEM ON THE BASIS
OF DYNAMIC MODELS, DESIGNED ACCORDING TO EXPERIMENTAL DATA

[Synopsis of article by B. M. Konyukhov, I. K. Lipeikene, V. T. Shepel]

[Text] Describes a method for evaluating the change of state moment of a
mechanical system, based on dynamic models designed according to experimental
data, which allows the exclusion of erroneous solutions about the occurrence
of defects when background distortions of the monitored parameters observed
sequences of values are present. Illustr. 8, bibliogr. 2.

A MULTI-STAGE PARAMETERS MEASUREMENT PROCEDURE OF A REPEATED SIGNAL USING A
DIGITAL COUNTS STOCHASTIC AVERAGING METHOD

[Synopsis of article by Yu. N. Gorbunov]

[Text] The investigated measurement procedure, discussed in the article as
a multi-stage Monte Carlo method measurement procedure, permits, in the ex-
treme case after n measurements have been done, an increase of instrument
accuracy by a factor of $n^{3/4}$ton, which reveals an additional potential for
increasing accuracy in comparison to the familiar two-stage procedure.
Illustr. 1, bibliogr. 1.

INTERACTIVE SYSTEM OF PROCESSING EXPERIMENT RESULTS, PRESENTED IN TABULAR FORM

[Synopsis of article by I. F. Klistorin, G. A. Tkach, G. Ya. Shevchenko]

[Text] The DISK system presented is directed towards solution of classifica-
tion processing problems for experimental data of different types, it is
implemented on an "Elektronika-60" computer, and operates with the RAFOS
operating system. The system permits effective processing and classification
of projects of various nature. The selected tabular information presentation
format is completely convenient for data input, data processing, and subse-
quent storage. Bibliogr. 2.

A PACKAGE OF EXTERNAL ROUTINES FOR PROGRAM PREPARATION SYSTEMS ON THE BASIS
OF AN "ELEKTRONIKA DZ-28" MINICOMPUTER

[Synopsis of article by M. M. Dechko, L. B. Reznik]

[Text] Presents the characteristics of an external subroutines package for
an "Elektronika DZ-28" minicomputer. The package was implemented in machine
code and provides for the completion of the more frequently encountered
computational problems of scientific research.

THE KAMAK DISTRIBUTED SYSTEM ON A MICROCOMPUTER FOR AUTOMATION OF FIELD
EXPERIMENTS

[Synopsis of article by V. V. Kolobkov, A. E. Martynov, A. Ya. Oleinikov,
E. V. Pankrats, A. De Pole, N. A. Tikhomirov]

[Text] Describes the KAMAK distributed system on a microcomputer, intended
to automate the sampling, processing, and presentation of data in expedition
experiments carried out in areas such as cosmic research, environmental
protection, useful minerals exploration, storm sources research, and others
which require recording and processing large information flows. The system
is built on the basis of two microcomputers, an analog magnetic tape recorder,
and a digital tape unit, with a main memory capacity of 128K words, compatible
with SM EVM, and implemented in the form of a KAMAK module in conformity
with the EUR-6500 standard. System software is built on the basis of program-
ming KAMAK systems with the framework of an Assembler and high level
languages. Illustr. 2, bibliogr. 8.

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